

MUST MEMORIZE MENTAL MATHS

TABLES till 10 and Table of 25 → Percentages

25	125
50	150
75	175
100	200

SQUARE

$$1^2 = 1$$

$$11^2 = 121$$

$$2^2 = 4$$

$$12^2 = 144$$

$$3^2 = 9$$

$$13^2 = 169$$

$$4^2 = 16$$

$$14^2 = 196$$

$$5^2 = 25$$

$$15^2 = 225$$

$$6^2 = 36$$

$$16^2 = 256$$

$$7^2 = 49$$

$$17^2 = 289$$

$$8^2 = 64$$

$$18^2 = 324$$

$$9^2 = 81$$

$$19^2 = 361$$

$$10^2 = 100$$

$$20^2 = 400$$

CUBES

$$1^3 = 1 \times 1 \times 1 = 1$$

$$2^3 = 2 \times 2 \times 2 = 8$$

$$3^3 = 3 \times 3 \times 3 = 27$$

$$4^3 = 64$$

$$5^3 = 125$$

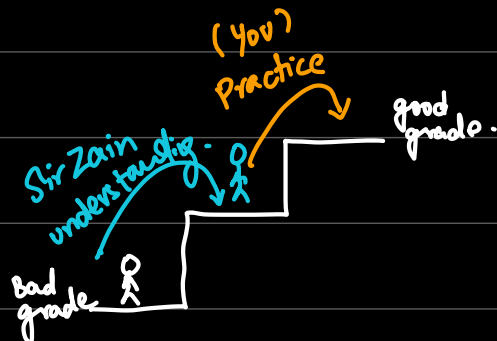
$$6^3 = 216$$

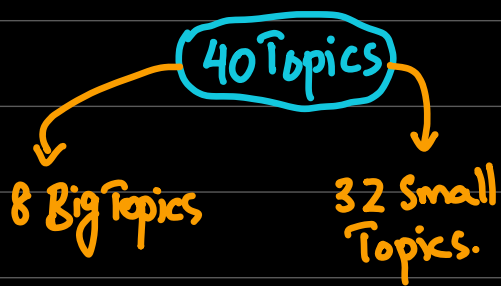
$$7^3 = 343$$

$$8^3 = 512$$

$$9^3 = 729$$

$$10^3 = 1000$$





O LEVELS (4024)

IGCSE(0580)

P1 2h Small Questions
No calculator

P2 1h 30min Small Questions
Calculator allowed.

P2 2h 30min Big Questions
Calculator Allowed.

P4 2h 30min Big Questions
Calculator Allowed.

(ARITHMETICS)

(5 Marks)

- ✓ 1 - BODMAS.
- ✓ 2 - FRACTIONS
- 3 - DECIMALS.
- 4 - DIFFERENCE + MIDDLE VALUE
- ✓ 5 - NUMBER FAMILIES.
- 6 - ADDITION SUBTRACTION RULES

BODMAS

1) $18 - 2 \times 3 + 4$

$$18 - 6 + 4$$

$$18 - 2$$

$$16$$

Major Blunder!

$$18 - 6 + 4$$

$$18 - 10$$

$$8$$

2) 3×2^3
 6^3 (Wrong)

$$= 3 \times 8$$

$$= 24$$

3) 2×5^x
 10^x (Wrong)

4) $\sin 30 \times 2$
 $\sin 60$ (Wrong)
 $2\sin 30$ (Correct)

BODMAS
 ↓
 Operators
 1) Power
 2) sin/cos/tan

5) $\sin x \times 3$
 $\sin 3x$ (Wrong)
 $3\sin x$ (Correct)

ADD / SUB	MULTIPLY / DIVIDE				
Same sign → ADD } Sign of opp sign → sub } Bigger no	<table> <tr> <td>$++ = +$</td><td>$+- = -$</td></tr> <tr> <td>$-- = +$</td><td>$-+ = -$</td></tr> </table>	$++ = +$	$+- = -$	$-- = +$	$-+ = -$
$++ = +$	$+- = -$				
$-- = +$	$-+ = -$				
$-3 + 5 = +2$	$(-2) \times 3 = -6$				
$-2 - 9 = -11$	$\frac{-6}{-3} = +2$				
$-2x + 12x = +10x$	$(-5) \times (-3) = +15$				
$-4y - 12y = -16y$	$\frac{4}{-2} = -2$				
$-21 + 5 = -16$					
$4 - 18 = -14$					
$-3 - 11 = -14$					

FRACTIONS

ADD / SUB

(Rule: Make denominator same)

$$\frac{3}{4} + \frac{1}{5} = \frac{15+4}{20} = \frac{19}{20}$$

$$\frac{5 \times 3}{5 \times 4} + \frac{1 \times 4}{5 \times 4} = \frac{15}{20} + \frac{4}{20} = \frac{19}{20}$$

$$\begin{aligned} \textcircled{2} \quad \frac{3}{4} + \frac{7 \times 2}{2 \times 2} \\ \frac{3}{4} + \frac{14}{4} &= \frac{3+14}{4} \\ &= \frac{17}{4} \end{aligned}$$

$$\begin{aligned} \textcircled{3} \quad \frac{5}{2x} + \frac{3 \times 2}{x \times 2} \\ \frac{5}{2x} + \frac{6}{2x} &= \frac{5+6}{2x} = \frac{11}{2x} \end{aligned}$$

$$\textcircled{3} \quad \frac{3}{2x} + \frac{4}{3x+1}$$

$$\frac{3(3x+1) + 4(2x)}{2x(3x+1)}$$

$$\frac{9x+3+8x}{2x(3x+1)} = \frac{17x+3}{2x(3x+1)}$$

MULTIPLY

$$\textcircled{1} \quad \frac{3}{5} \times \frac{2}{7} = \frac{6}{35}$$

$$\frac{2}{1} \left(\frac{3}{5} \right) = \frac{6}{5}$$

$$2 \left(\frac{2x+1}{3} \right) = \frac{4x+2}{3}$$

No need to open
brackets in denominators.
They are simplified this way.

FRACTIONS	MATRICES VECTORS
$\frac{2}{1} \left(\frac{6}{5} \right) = \frac{12}{5}$	$2 \begin{pmatrix} 6 \\ 5 \end{pmatrix} = \begin{pmatrix} 12 \\ 10 \end{pmatrix}$

This correction will fix three chapters.
(Matrices) (vectors) (Algebra).

Solve leaving your answer as improper fraction.

DIVIDE

$$\frac{3}{5} \div \frac{4}{7}$$

$$\frac{3}{5} \times \frac{7}{4} = \frac{21}{20}$$

PROPER
 $N < D$

$$\frac{2}{5}$$

IMPROPER
 $N \geq D$

$$\frac{3}{2}$$

IMPROPER



MIXED

$$\frac{11}{9}$$

LONG
DIVISION

$$\begin{array}{r} 1 \\ 9 \overline{) 11} \\ \underline{-9} \\ 2 \end{array} \rightarrow \boxed{1} \frac{\boxed{2}}{\boxed{9}}$$

MIXED



IMPROPER

$$3 \frac{2}{5} = \frac{17}{5}$$

$\frac{4.5}{3}$ ✗ Mixture of decimal and fraction
hence we cannot leave as
final Answer.

$\frac{3}{2} \longrightarrow 1\frac{1}{2} \longrightarrow 1.5$

If Question is silent, all of these are correct.

oe = or equivalent forms.

DECIMALS

→ (STANDARD FORM) (SIG FIGS) (MATRICES)

ADD/SUB: Rule decimal beneath decimal.

① $12.35 + 6.4$

$$\begin{array}{r} 12.35 \\ + 6.4 \\ \hline \end{array}$$

X

$$\begin{array}{r} 12.35 \\ + 06.40 \\ \hline 18.75 \end{array}$$

② $12.35 - 6.4$

$$\begin{array}{r} 11 \\ \cancel{12}.35 \\ - 06.40 \\ \hline 05.95 \end{array}$$

MULTIPLY

$$\textcircled{1} \quad 0.02 \times 1.6 = 0.032$$

2dp + 1dp = 3dp

$$\begin{array}{r} 2 \\ \times 16 \\ \hline 32 \end{array}$$

$$2.4 \times 0.003 = 72$$

1dp + 3dp = 4dp

$$\begin{array}{r} 24 \\ \times 3 \\ \hline 72 \end{array}$$

$$9 \times 0.3 = 2.7$$

0dp + 1dp = 1dp

DIVIDE

Method 1

$$\textcircled{1} \quad \frac{1.6}{0.4} = \frac{16}{4} = 4$$

$$\textcircled{2} \quad \frac{0.32}{0.2} = \frac{32}{20} \times \frac{16}{10} = \frac{16}{10} = 1.6$$

$$\textcircled{3} \quad \frac{6.3}{9.0} = \frac{63}{90} \times \frac{1}{10} = \frac{7}{10} = 0.7$$

✓ 9 and 9.0 is same.

✗ 9 and 0.9 are different.

Method 2

$$\textcircled{1} \quad \frac{1.6 \times 10}{0.4 \times 10} = \frac{16}{4} = 4$$

$$\textcircled{2} \quad \frac{0.32 \times 100}{0.2 \times 100} = \frac{32}{20} \times \frac{16}{10} = 1.6$$

$$\textcircled{3} \quad \frac{6.3 \times 10}{9 \times 10} = \frac{63}{90} \times \frac{1}{10} = 0.7$$

$\frac{1234}{10} = 123.4$	$\frac{1234}{1000} = 1.234$
$\frac{1234}{100} = 12.34$	$\frac{7}{10} = 0.7$

For 0 levels (4024) only.

In P1 Tactic for decimal.

eg: $\frac{\cancel{24}}{\cancel{40}} \frac{6}{10} = 0.6$

$$\frac{2^{x2}}{5^{x2}} = \frac{4}{10} = 0.4$$

$$\frac{3^{x4}}{25^{x4}} = \frac{12}{100} = 0.12$$

We want to make denominator 10/100/1000 so that we can quickly convert to decimal.

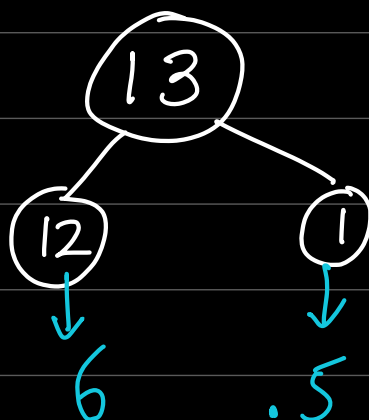
$$\frac{7^{x5}}{20^{x5}} = \frac{35}{100} = 0.35$$

$$\frac{7 \div 2}{20 \div 2} = \frac{3.5}{10} = 0.35$$

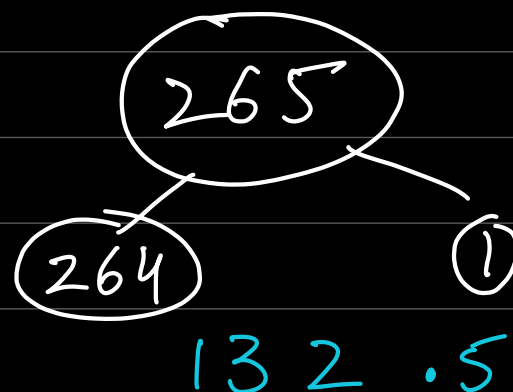
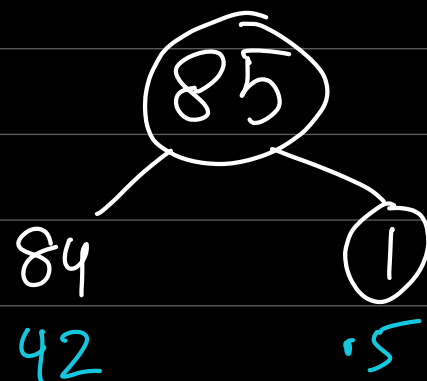
P1 Tactic Half Any number mentally.

24
↓ ↓
12

48
↓ ↓
24



6.5



MEMORIZE THESE!

$$\frac{1}{2} = 0.5$$

$$\frac{1}{5} = 0.2$$

$$\frac{1}{4} = 0.25$$

$$\frac{3}{4} = 0.75$$

$$12 \times 0.75 = \cancel{12}^3 \times \frac{3}{4} = 9$$

$$25 \times 0.2 = 25 \times \frac{1}{5} = 5$$

DIFFERENCE

Arithmetic + STATS + Algebraic Scenario.

Difference is always Positive.

$$\text{DIFFERENCE} = \text{Bigger} - \text{Smaller}$$

Q. Find difference between
-7 and -13

$$\begin{aligned}\text{Diff} &= B - S = (-7) - (-13) \\ &= -7 + 13 \\ &= +6\end{aligned}$$

For sciences only:

$$\text{Change} = \text{final} - \text{initial}$$

Change can have a negative value.

$v=5$

Before

$v=1$

After.

$$\begin{aligned}\text{Change} &= \text{FINAL} - \text{INITIAL} \\ &= 1 - 5 = -4\end{aligned}$$

Midway / Halfway value

Arithmetic
+ STATS.

Q. Find the decimal value that lies exactly halfway of 3.7 and 5.3

Step 1: ADD

Step 2: $\div 2$

$$\frac{3.7 + 5.3}{2} = \frac{9}{2} = 4.5$$

Q. Find fraction that is exactly halfway of $\frac{1}{7}$ and $\frac{4}{7}$

Step 1: Add

$$\frac{1}{7} + \frac{4}{7}$$

$$= \frac{5}{7}$$

M = method
A = Answer.

(1 mark) $\longrightarrow$ A1

Step 2:

$$\frac{5}{7} \div 2$$

$$\frac{5}{7} \times \frac{1}{2} = \frac{5}{14}$$

2 marks

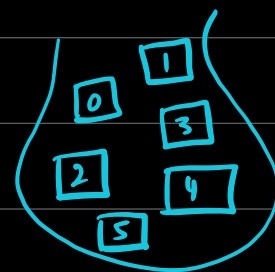
M1	✓	✓	x
A1	✓	x	✓
	2	1	Zero

NUMBER FAMILIES

Grade 11

(Set Notation)

(Probability)



NO DECIMAL OR FRACTIONS.

1 NATURAL : 1, 2, 3, 4
NUMBERS

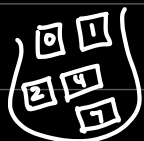
2 WHOLE : 0, 1, 2, 3, 4 ...
NUMBERS

Examiner's Fav Word.

3 INTEGERS (Any number without decimal or fraction)
..... -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6

4 EVEN NUMBERS (leaves No remainder when divided by 2)

0 2, 4, 6, 8, 10
✓



$$\begin{array}{r} 6 \\ 2 \overline{) 12} \\ \underline{-12} \\ 0 \end{array}$$

5 ODD NUMBERS

1, 3, 5, 7, 9, 11

6 PRIME NUMBERS (EXACTLY TWO FACTORS)

1

2

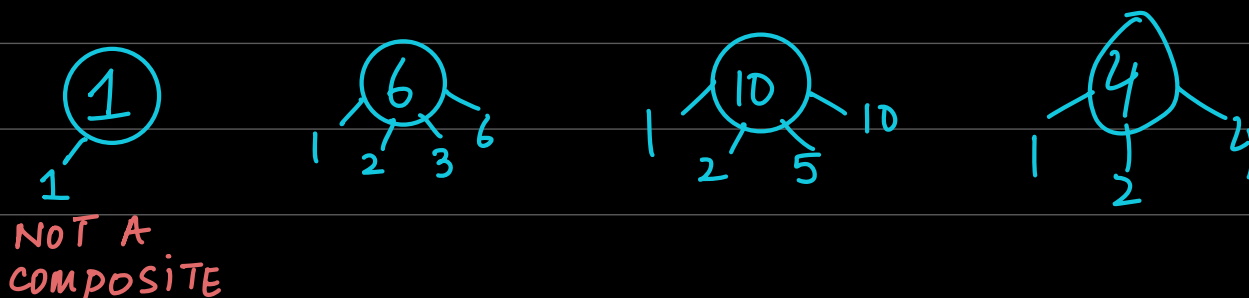
3

5

11

NOT A
PRIME

7 COMPOSITE NUMBERS (more than 2 factors)



(1 and 0 are not a part of prime/composite family :))

FACTORS

MULTIPLES

1, 2, 3, 4, 6 12 24, 36, 48, 60 ...



12 is both a
factor and a
multiple of
itself.

π , $\frac{22}{7}$, 3.142 are all
completely different numbers.



They are just really close to each other.

RATIONAL

can be written as a pure fraction = $\frac{p}{q}$

a) $0.3 = \frac{3}{10}$ ✓

b) $0.0005 = \frac{5}{10000}$ ✓

c) $3.142 = \frac{3142}{1000}$ ✓

d) $\frac{22}{7}$ ✓

e) $-6 = -\frac{6}{1}$ ✓

f) $\sqrt{16} = 4 = \frac{4}{1}$ ✓

g) Recurring Decimals are rational.

h) $\frac{1.2 \times 10}{3 \times 10} = \frac{12}{30}$ ✓

IRRATIONAL

Cannot be written as a pure fraction.

Irrational numbers are of 3 types.

1- π (symbol only)

2- $\sqrt{\square}$ not exact
 $\sqrt{2}, \sqrt{3}, \sqrt{5}, \sqrt{6}$ etc

3- $\sqrt[3]{\square}$ not exact
 $\sqrt[3]{2}, \sqrt[3]{3}, \sqrt[3]{4}$ etc.

$0.123456 = \frac{123456}{1000000}$ ✓

$0.123456789 = \frac{123456789}{1000000000}$ ✓

$\pi = 3.14159 \dots$ we do not know how many zeros to divide with?

RECURRING DECIMALS

$0.\dot{3} = 0.33333 \dots$

$0.12\dot{5} = 0.125555 \dots$

$0.1\dot{3}6 = 0.1363636 \dots$

$0.1\dot{2}\dot{3} = 0.123123123 \dots$

Maths ppl have a very clever way to convert Recurring decimals to fractions. eg

$0.\dot{3} = 0.333 \dots = \frac{1}{3}$

Q. $\frac{22}{7}$, π , $3\sqrt{2}$, $\sqrt{2} \times \sqrt{8}$

↑ irrational ↑ irrational
 $\sqrt{2 \times 8}$

Circle the irrational ones.

$\sqrt{16} = 4 = \frac{4}{1}$
 Rational.

Q. Write down an irrational number between 3 and 4.

$\sqrt{9}$ Rational $\sqrt{10}, \sqrt{11}, \sqrt{12}, \sqrt{13}, \sqrt{14}, \sqrt{15}$ all are irrational $\sqrt{16}$ Rational.
 Ans: π $\sqrt{12}$

Any one in Ans.

Q. Write down an irrational number between 1 and 2

$\sqrt{1}$ Rational $\sqrt{2}, \sqrt{3}$ irrational $\sqrt{4}$ Rational
 Ans: $\sqrt{3}$

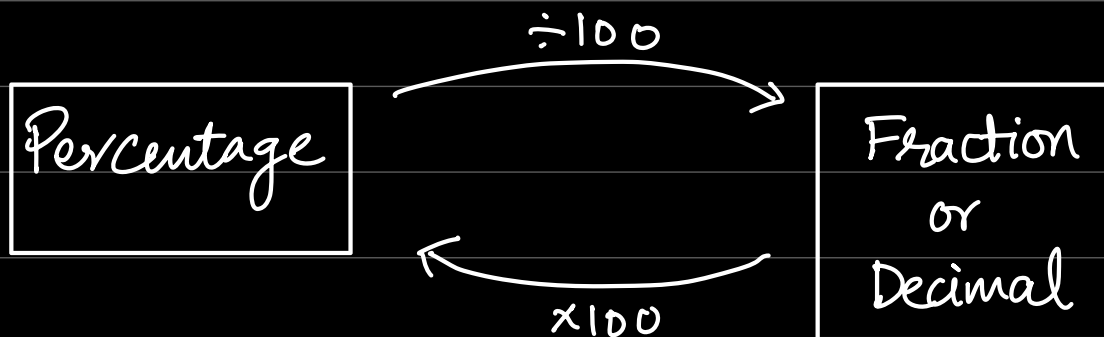
Q. Write down an irrational number between 7 and 8.

$\sqrt{49}$ $\sqrt{50}, \sqrt{51}, \dots, \sqrt{63}$ $\sqrt{64}$

irrational

Ans: _____

JS3



Q. (i) Express 8% as decimal = $\frac{8}{100} = 0.08$

(ii) Express 40% as fraction in lowest form:

$$\frac{40}{100} = \frac{\cancel{4}^2}{\cancel{10}^5} = \frac{2}{5}$$

(iii) Express $\frac{3}{4}$ as a percentage.

$$\frac{3}{4} \times \frac{25}{1} = 75\%$$

(iv) Express 0.12 as Percentage.

$$0.12 \times 100 = 12\%$$

Memorize THESE.

$$\frac{1}{2} = 0.5$$

$$\frac{1}{5} = 0.2$$

$$\frac{1}{4} = 0.25$$

$$\frac{3}{4} = 0.75$$

To arrange, convert each number to decimal with 1 more dp than given in the question.

21 Arrange these values in order of size, starting with the smallest.

$$\frac{9}{20} \quad \frac{9 \times 5}{20 \times 5} = \frac{45}{100}$$

0.39

$$46\% \quad \frac{46}{100}$$

$$\frac{2}{5} \quad \frac{2 \times 2}{5 \times 2} = \frac{4}{10} = 0.4$$

0.450

0.390

0.460

0.400

3

1

4

2

In Ans space always write original numbers.

Answer 0.39 $\frac{2}{5}$ $\frac{9}{20}$ 46% [2]
smallest

Always make 1 extra decimal place than given value.

21 Arrange these values in order of size, starting with the smallest.

$$\frac{9 \times 5}{20 \times 5} = \frac{45}{100}$$

0.39

$$\frac{46}{100}\%$$

$$\frac{2 \times 2}{5 \times 2} = \frac{4}{10}$$

0.450

(3)

0.390

(1)

0.460

(4)

0.400

(2)

Note: Always write the original numbers in the answer space.

Answer 0.39 $\frac{2}{5}$ $\frac{9}{20}$ 46% [2]
smallest

(b) Arrange these fractions in order, beginning with the smallest.

$$\frac{8 \times 4}{8 \times 5}$$

$$\frac{3 \times 10}{4 \times 10}$$

$$\frac{31 \times 1}{40 \times 1}$$

$$\frac{32}{40}$$

(3)

$$\frac{30}{40}$$

(1)

$$\frac{31}{40}$$

(2)

Answer $\frac{3}{4}$ $\frac{31}{40}$ $\frac{4}{5}$ [1]
smallest

53 Arrange these numbers in order, starting with the smallest.

$$\frac{3}{4}$$

0

-1

$$-\frac{17 \times 5}{20 \times 5} = -\frac{85}{100}$$

$$-\frac{4 \times 2}{5 \times 2} = -\frac{8}{10}$$

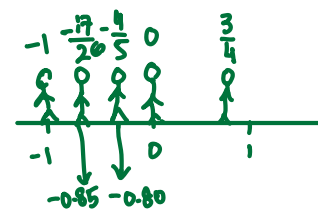
0.75

0

-1

-0.85

-0.80



Answer -1 $-\frac{17}{20}$ $-\frac{4}{5}$ 0 $\frac{3}{4}$ [2]
smallest

59 (a) James thinks of a **two-digit** number.

It is a cube number.

It is an even number.

What is his number?



Answer [1]

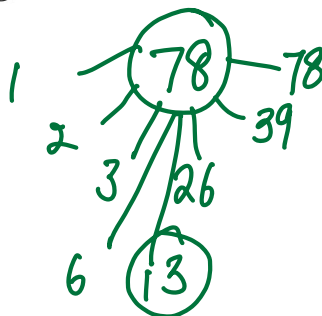
64

(b) Omar thinks of a **two-digit** number.

It is a factor of 78.

It is a prime number.

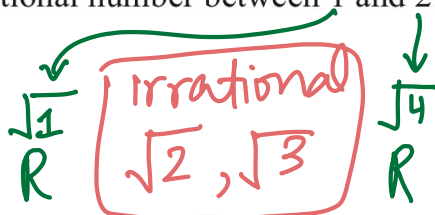
What is his number?



Answer [1]

13

(c) Write down an irrational number between 1 and 2.



Answer [1]

sqrt(2)

0.66666...

0.6

0.6

0.66

0.67

0.600

0.667

0.660

0.670

①

③

②

④

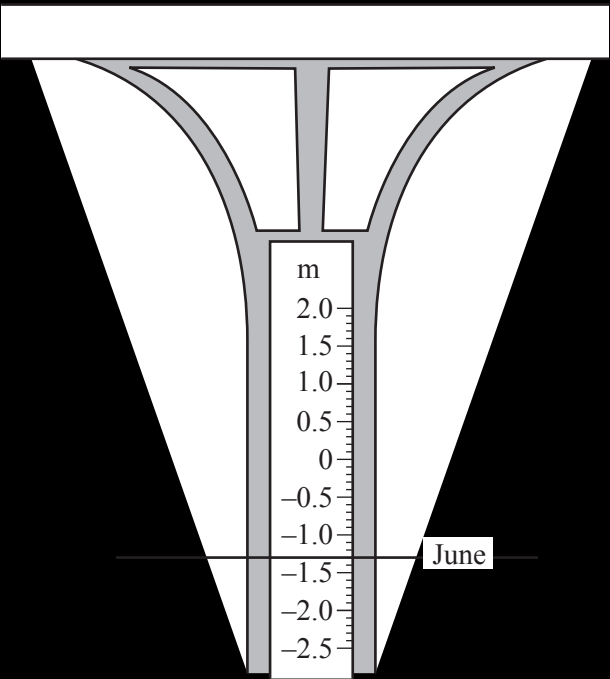
Notes copy.

Statement	True or False	Example (if false)
$n^3 > 1$		
$\frac{1}{n} > \frac{1}{n^2}$		
$(n - 1)(n + 3)$ is always odd		

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Vostok												
London												

	Asia	Africa	Europe	South America
Highest point (m)				
Lowest point (m)				

58 The diagram shows a scale used to measure the water level in a river.



The table shows the reading, in metres, at the beginning of each month.

Month	January	February	March	April	May	June	July
Reading (m)	0.8	1.2	1.3	0.5	-0.1		-1.9

(a) The diagram shows the water level at the beginning of June.

Complete the table with the June reading. [1]

(b) Work out the difference between the highest and lowest levels shown in the table.

Answerm [1]

(c) The August reading was 0.4 m higher than the July reading.

Work out the reading in August.

Answerm [1]

72 Write these numbers in order of size, starting with the smallest.

$$\frac{13}{20} \quad 0.7 \quad \frac{7}{12} \quad 0.64 \quad \frac{5}{8}$$

Answer [2]
smallest

73 Omar has a pack of number cards.
He picks these five cards.



(a) Write down the mode of the five numbers.

Answer [1]

(b) He takes another card from the pack.

(i) If the mean of the six numbers is -1 , what number did he pick?

Answer [1]

(ii) If the difference between the highest and lowest of the six numbers is 12,
what are the **two** possible numbers he could have picked?

Answer or [1]

78 (a) Evaluate $(2.05 + 1.4) \times 0.2$.

Answer [1]

(b) Evaluate $1\frac{1}{3} - \frac{4}{5}$.

Answer [1]

79 The table shows some information about the temperatures in a city.

Date	Maximum temperature	Minimum temperature
1 February	-10°C	$T^{\circ}\text{C}$
1 March	4°C	-5°C

(a) Find the difference between the maximum and minimum temperatures on 1 March.

Answer $^{\circ}\text{C}$ [1]

(b) The minimum temperature, $T^{\circ}\text{C}$, on 1 February was 13 degrees lower than the minimum temperature on 1 March.

Find T .

Answer $T =$ [1]
